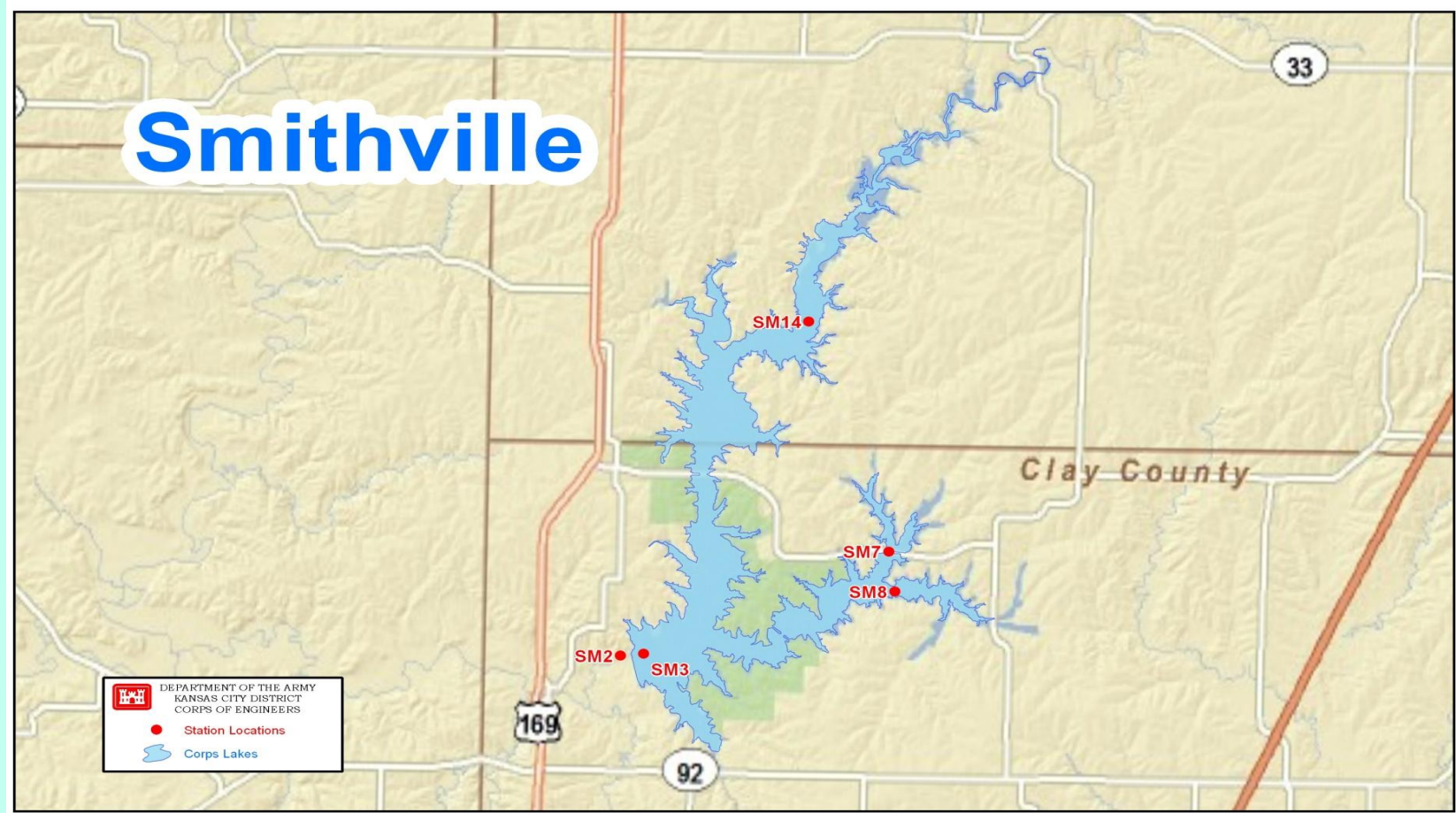


# Smithville Lake Water Quality Summary

## 2003-2012

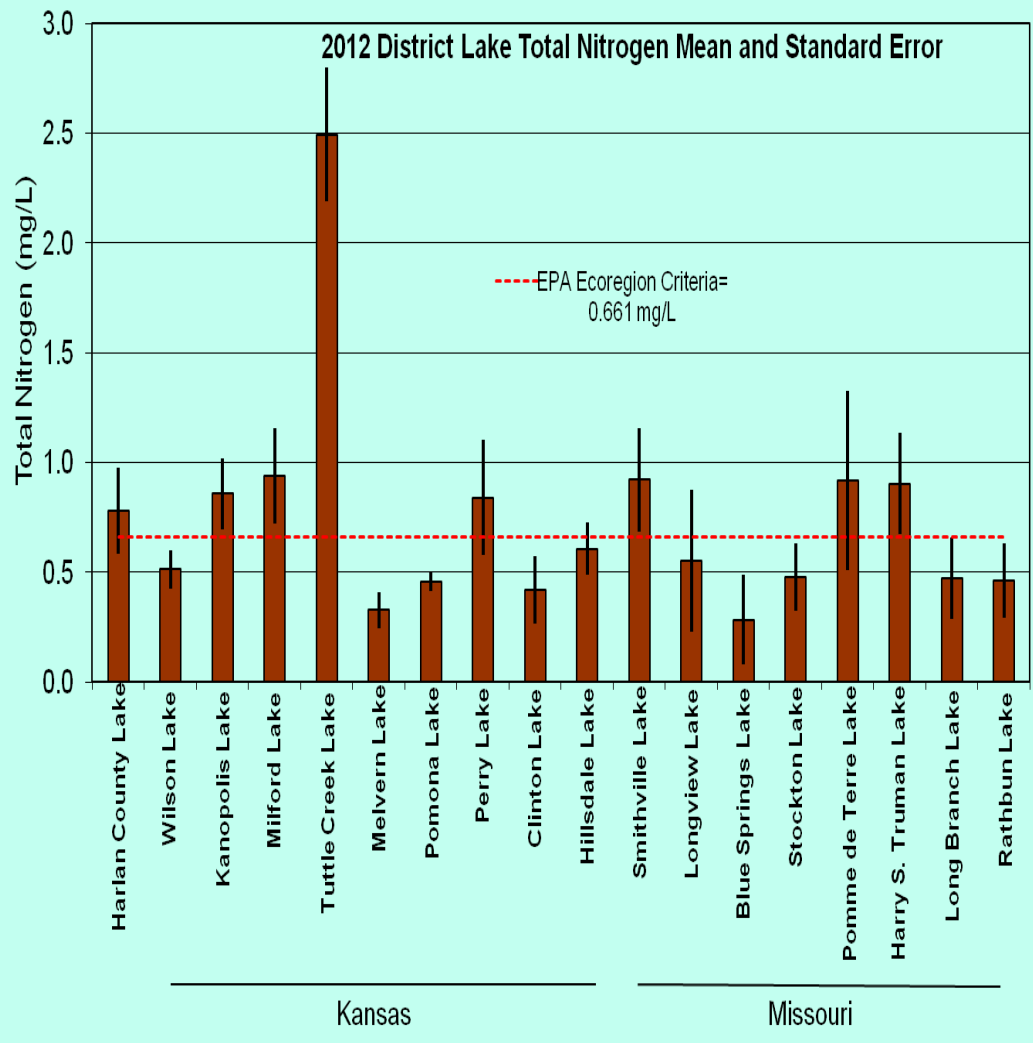
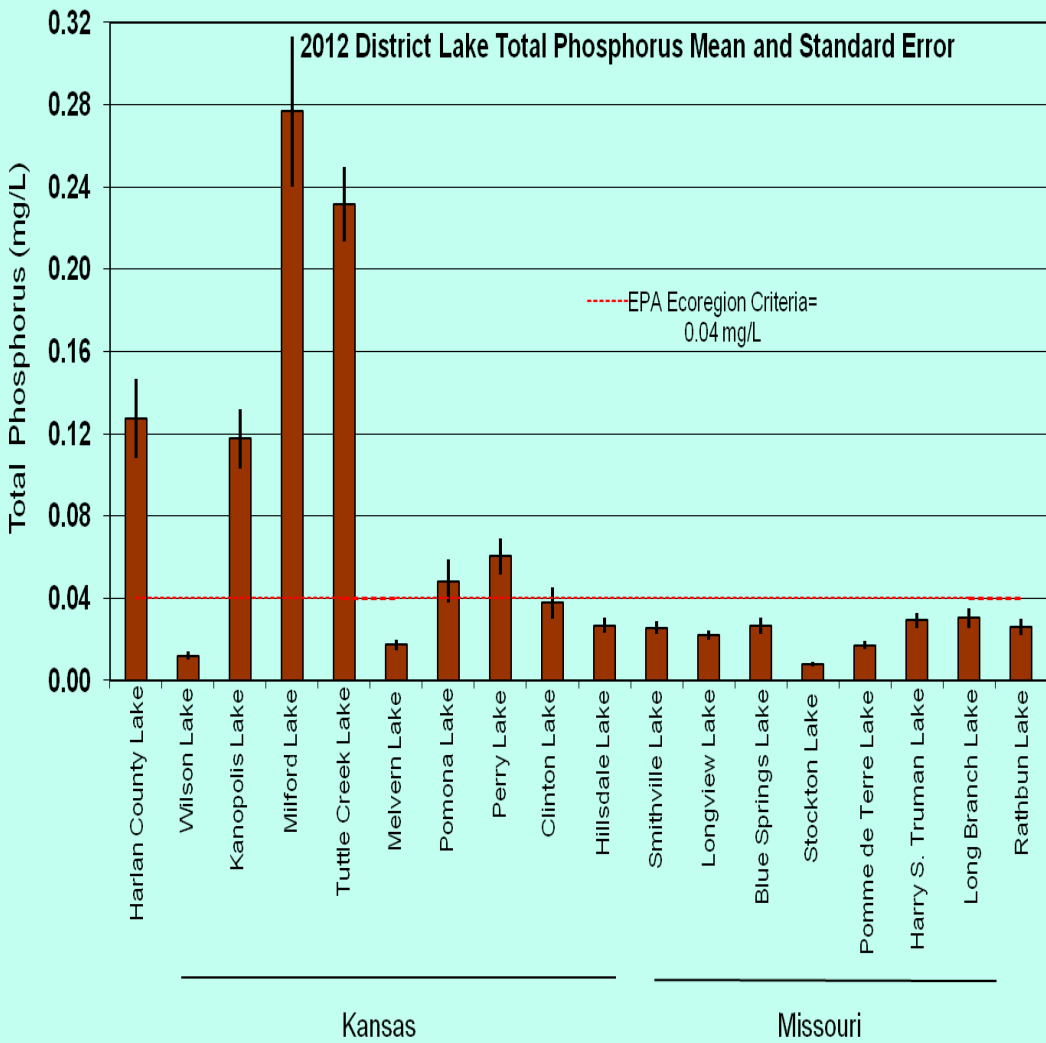


### Smithville Lake

- Built on Little Platte River reaching full pool in 1982.
- **Watershed** = 213 square miles/ 136,320 Surface Acres (SA)
- **Capacity:** Flood Control: 101,777 Acre-feet (AF) / 9,990 SA
  - Multipurpose: 141,666 AF / 7,115 SA / 175 miles of shoreline
  - Avg. annual inflow (2003-2012)=107713 AF; 2012 inflow=42,619 AF
- **Operating project purposes:** flood control, water quality, recreation, fish and wildlife, and water supply
- **Water Quality** at Smithville Lake in 2012 was beneficial to operating purposes listed above and did not exceed MO State WQ Standards for designated uses. Water quality at Smithville Lake improves as nutrients, herbicides and sediments are removed by settling, dilution, and biological processes as water moves from inflow streams to the dam.

### Nutrient Enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish and aquatic plant growth rates and productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging process in lakes. This rapid aging process, called eutrophication, is responsible for changes in plant and aquatic life in lakes and water bodies including algal blooms, low dissolved oxygen that affect fish survival, and taste and odor issues in drinking water. In 2012, Smithville Lake was below the USACE Kansas City District lake averages for total phosphorus (0.06 mg/L), but higher than average for total nitrogen (0.75 mg/L). Smithville Lake average TP concentration was below the EPA ecoregion recommended criteria and most of the lake can be classified at the low end of eutrophic range (i.e. 0.24-0.96 mg/L) as described by Carlson's trophic class system. The level of biological productivity and associated aquatic plant and algae production at Smithville has not resulted in any negative impacts associated with excessive nutrients. Standard error bars in the figures below illustrate the variation in sample results from each site in 2012.

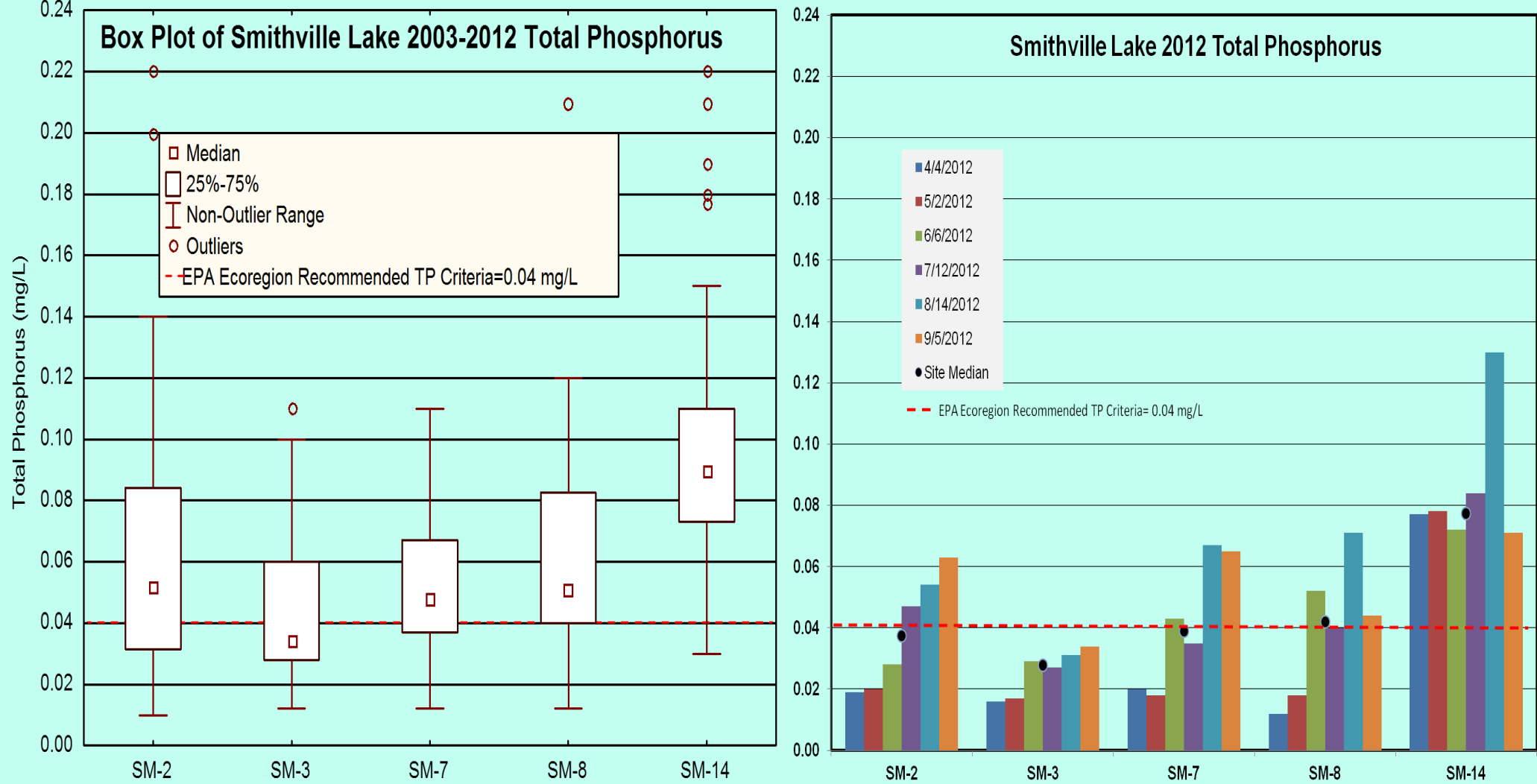


The **US Army Corps of Engineers** (USACE) Water Quality Program collects monthly water samples at Smithville Lake\* from April through September. These figures present data collected between 2003-2012 from four lake sites (#3,7,8,14), and the outflow (#2) below the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE uses this data to describe conditions and changes from the inflow streams, within the main lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

\*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

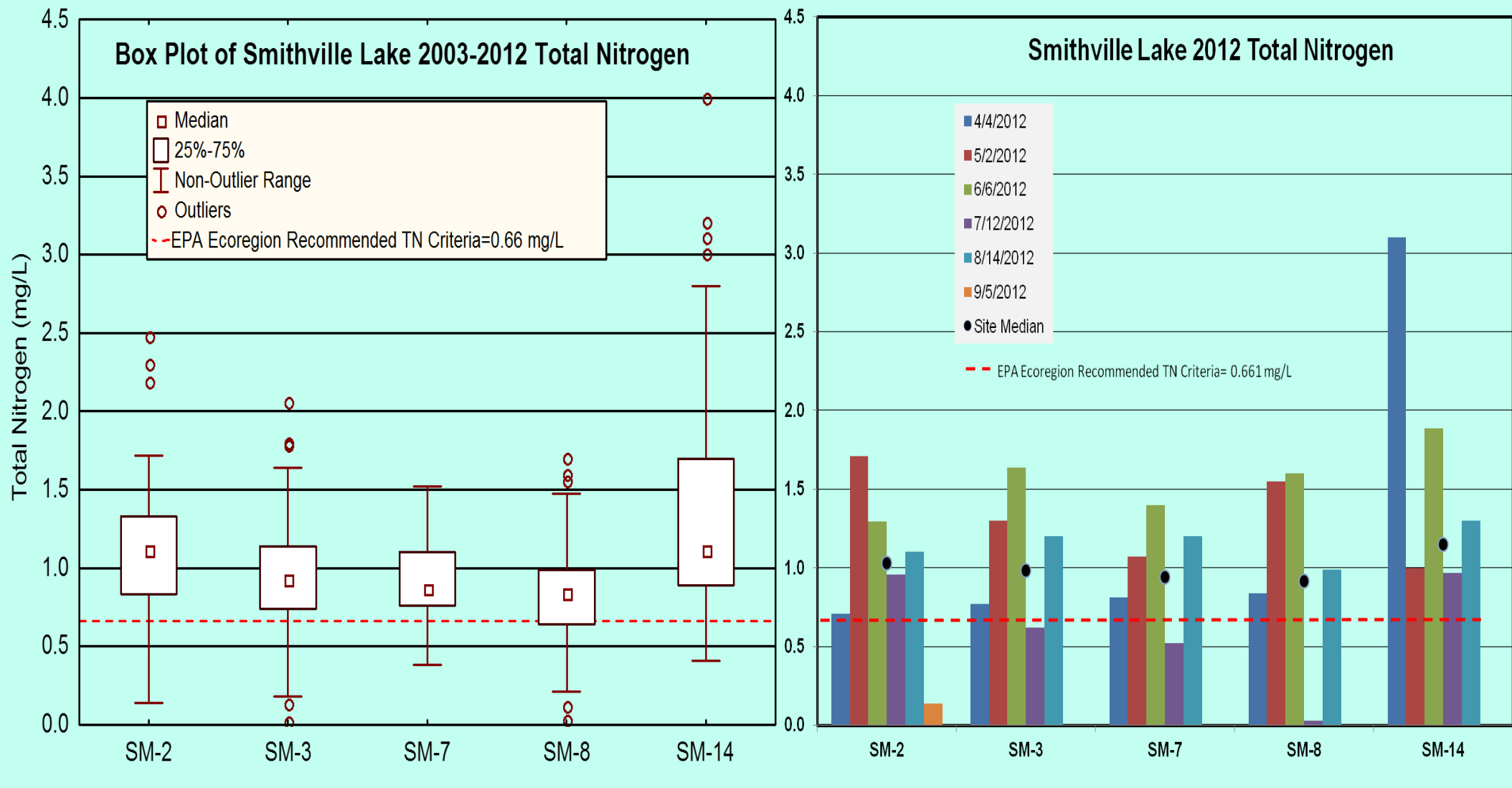
### Total Phosphorus

Total phosphorus (TP) median concentrations from 2012 Smithville Lake samples were similar to EPA ecoregion recommended criteria (0.04 mg/L) at lake sites except SM14. Similar to most impoundments, higher TP concentrations and a wider range of data is usually found in the upper lake sites and inflows due to mobilized nutrients bound to silt particles in moving water and biological uptake or consumption of nutrients as the water flows through the lake. Total phosphorus medians in 2012 were similar to 10-year trends, but April and May measurements all sites except SM-14 were in the bottom 25% of all measurements since 2003.



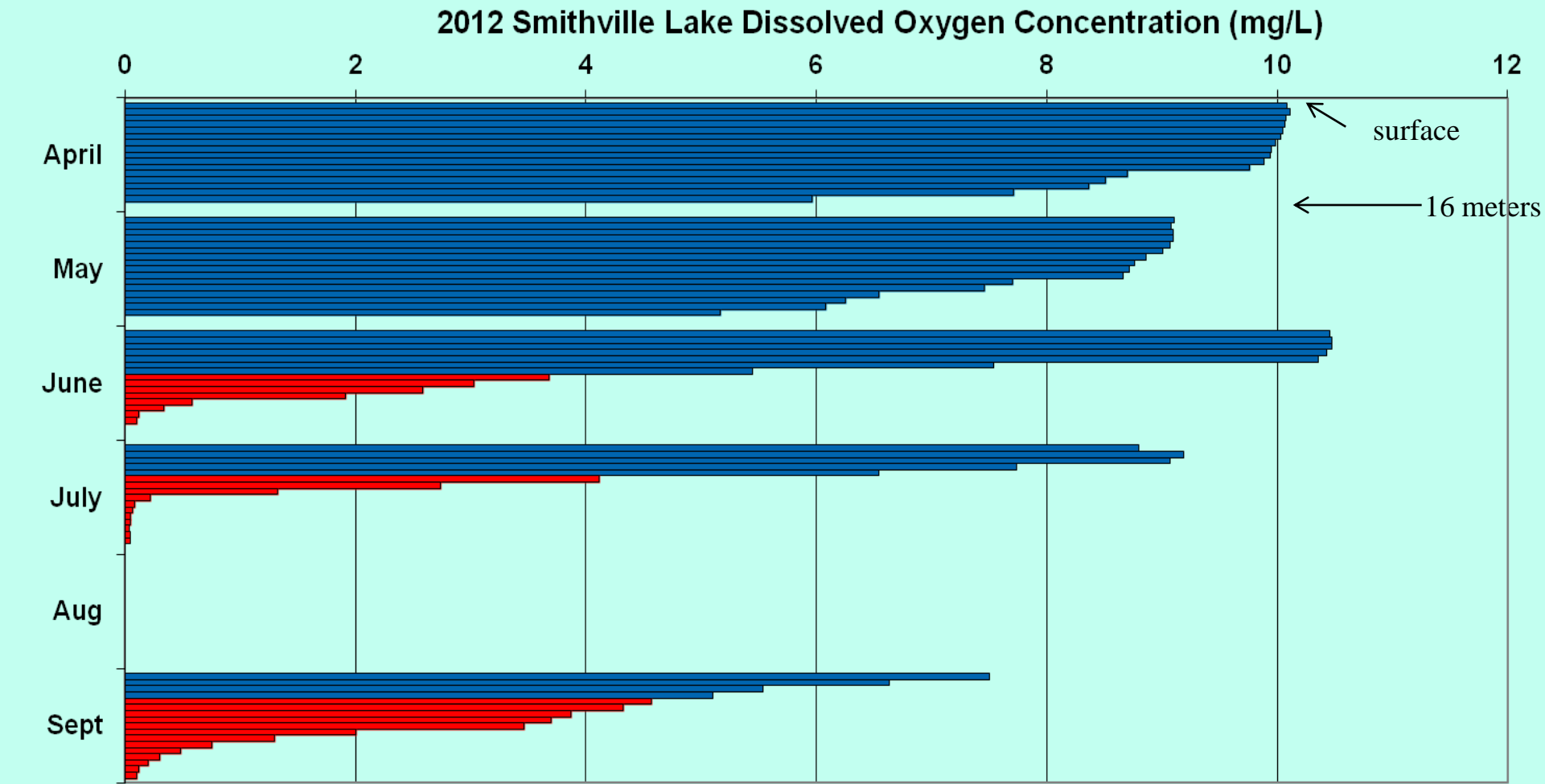
### Total Nitrogen

In 2012, median total nitrogen concentrations were similar to 10-year trends at lake sites and the outflow. All sites exceeded EPA ecoregion recommended criteria of 0.6 mg/L. Total nitrogen concentrations are highly variable between sites and years and most related to inflow levels and watershed factors (i.e. soils and farming practices). Low inflows were 39% of 10-year averages at Smithville Lake. Consequently, nutrient and sediment load from inflows were lower and less variable.



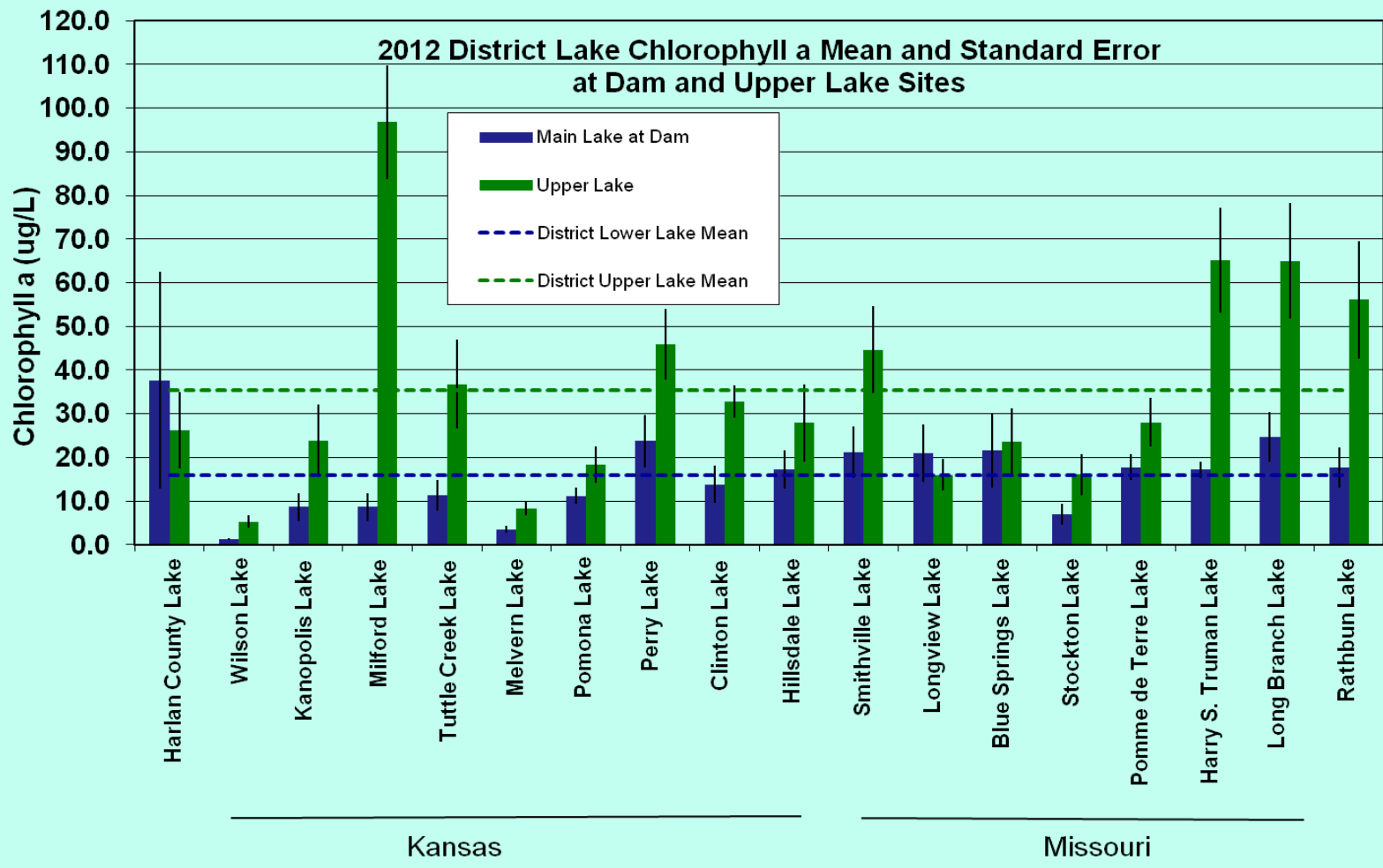
### Dissolved Oxygen

Dissolved oxygen (D.O.) is an important factor in aquatic species location, growth, and ultimately survival in lakes. Some lakes undergo a process called stratification and develop layers based on temperature, oxygen and chemistry. The figure below shows dissolved oxygen measured in the water column in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September at the dam (SM-3). Smithville Lake typically stratifies during summer months and low dissolved oxygen (i.e. 5 mg/L or less as shown in red) can stress aquatic life including fish. During the stratified period of 2012, Smithville Lake had sufficient dissolved oxygen from the surface layer to 4 meters.



### Algae

Algae and green plants are the base of the food chain in aquatic food webs and convert nutrients and CO<sub>2</sub> through photosynthesis into biomass for all aquatic life. Chlorophyll a is a measure of the active green pigment present in beneficial algae and harmful blue-green algae (cyanobacteria) active in this process. Chlorophyll a is a critical measurement as it relates nutrients like phosphorus and nitrogen to biological productivity related to algae (good and bad), aquatic invertebrate production, and fish growth. Smithville Lake typically has high levels (>20ug/L) of chlorophyll a in the upper and lower lake indicating nutrient enrichment. Blue-green algae is present, but not typically dominant and toxic blooms have not been documented.



### Water Quality Concerns:

- Eutrophication
- Nutrients
- Sediment inputs



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